



Name: \_\_\_\_\_ Date: \_\_\_\_\_

# READING SCIENCE!

## Kelp Forests and Ecosystem Balance



- 1 In the coastlines of the northern Pacific ocean there exists very unique and interesting ecosystems, the giant kelp forests. The kelp in these ocean forests can rise up to 80 meters from the ocean floor, creating a multi dimensional ladder of habitat for a variety of sea organisms. Two organisms play a fundamental role in the health of this ecosystem, the sea otter and the sea urchin. The sea otters are a keystone species within this ecosystem as their presence will largely determine whether the coast line will hold a kelp forest or become an overgrazed urchin barren.
- 2 How is this dynamic maintained? The sea otters eat a variety of shellfish, but a large portion of their diet consists of sea urchins. In turn, the sea urchins are herbivores that feed on ocean plants, especially the giant kelp. The sea otters feeding habits help to keep the population of sea urchins in check, which allows for the growth and reproduction of the kelp. The combination of sea otters, sea urchins, and kelp form a trophic cascade within this dynamic ecosystem, where the presence of the sea otters maintains the balance of the kelp forest ecosystem.
- 3 So what could occur if external factors interfered with this system? Apex consumers are organisms at the top of the food chain, and Apex consumers such as the sea otter play critical roles in the health of an ecosystem. If an external factor alters the apex consumer population, this can affect not only the individual organisms in the ecosystem, but also entire populations and communities. When apex consumer populations decline, the health of the entire ecosystem can become compromised.

- 4 In the 1990s scientists noticed that the sea otter populations were suddenly declining in the northern Pacific coastal ecosystems. They proposed that there might be some type of external factor affecting the sea otter population, but they did not have a reason why this was occurring. As a result of the otter die off, the kelp forests were starting to disappear. As the otter populations were removed from the system, the sea urchin populations were allowed to grow unchecked by the otters feeding habits. As a result, the sea urchin population exploded and they began to eat all of the kelp in the kelp forests.
- 5 In many places, the kelp forests became so overgrazed by sea urchins that they turned into urchin barrens. This was a problem for those regions as the presence of kelp forests had positively altered the dynamic of the coastline. The giant kelp beds reduced both wave height and intensity near the shore, creating safe and diverse habitat for many different ocean creatures. The disappearance of the kelp forests affected the populations of many other organisms. In fact, the entire kelp forest community was altered as a result of the decline in sea otters.
- 6 So why were the otters disappearing? After several studies, scientists found that orcas (killer whales) had inexplicably shifted their diets. They were suddenly eating the sea otters, a feeding practice that had not occurred at that level before the 1990s. Orcas traditionally fed on sea lions and harbor seals, and possibly on larger whales. However, in the years after 1990, new and expanding commercial fishing practices shifted the food sources of the sea lions and harbor seals.
- 7 Other groups of scientists concluded that factors affecting the feeding habits of the orcas could have to do with shifts in the temperatures of the oceans as a result of climate change. Shifting ocean currents may have changed the patterns of fish and other prey for the sea lions and harbor seals. Sea lions and harbor seals may have had to move to new hunting groups, making it difficult for the orcas to find them. Or, perhaps the numbers of the orca's traditional prey declined enough to force the orca to look for another food source. Whatever the reason, factors that were external to the kelp forest ecosystem severely affected not only the individual organisms within that ecosystem, but also populations of organisms within the entire kelp forest community.

Sources:

Estes, J.A., and J. Terborgh, 2010. *Trophic Cascades: Predators, Prey, and the Changing Dynamics of Nature*. Island Press, Washington DC.

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<http://www.npr.org/templates/story/story.php?storyId=4665067>

- 1 Based on paragraph 6, what do you think happened to the sea lions and harbor seals?
- A The orcas were eating too many of them.
  - B The fish they eat were being commercially overfished.
  - C Sea otters were eating their food.
  - D They began eating the kelp forests.
- 2 What is the keystone species in the giant kelp forest ecosystem?
- A The sea urchin
  - B The orca
  - C The sea otters
  - D The giant kelp
- 3 What is a potential external stimulus that may have affected the giant kelp forest ecosystem?
- A The feeding habits of the sea otters
  - B The feeding habits of the sea urchins
  - C The feeding habits of the other organisms within the kelp forest
  - D The feeding habits of harbor seals and sea lions
- 4 What would be a negative consequence of the kelp forest ecosystem falling out of balance?
- A Increased wave height and intensity
  - B A loss of diversity within the ecosystem
  - C An increase in the sea urchin population
  - D All of the above

5 The combination of sea otters, sea urchins, and kelp form —

- A a northern Pacific coastline.
- B a trophic cascade.
- C an apex consumer.
- D good fishing grounds for commercial fishermen.

6 What is an urchin barren?

- A A giant kelp forest that has been overgrazed by sea urchins.
- B A situation where the sea otters have eaten all of the urchins.
- C An external factor that has affected the sea urchins.
- D None of the above